



Production and reproduction performances of Diara buffaloes in the Gangetic basin of Bihar

P C CHANDRAN¹, S JEGAVEERA PANDIAN², A DEY³, REENA KAMAL⁴ and RAJNI KUMARI⁵

ICAR-Research Complex for Eastern Region, Patna, Bihar 800 014 India

Received: 21 January 2015; Accepted: 23 February 2015

ABSTRACT

Morphometric and body weight traits studied in the present investigation indicate that Diara buffaloes are medium-sized animals with prominent forehead and loosely curved horns. They are smaller than the heavy-sized breeds like Murrah, Jaffarabadi and Nili-Ravi. The height, length and girth of female Diara buffaloes were 94.96±0.58 cm, 92.96±0.49 cm and 115.93±0.81 cm up to 1 year of age and 133.60±0.69 cm, 138.36±0.74 cm and 200.79±0.95 cm above 7 years of age, respectively. Estimated adult body weights of Diara buffaloes pooled over ages were found to be 494.99±27.15 kg in males and 483.21±3.58 kg in females. Diara buffaloes are good milkers with an average per day milk production was found to be 7.8 litre and peak yield reached up to 10.5 litre per day. Diara population remains so far largely untouched and breed improvement programmes, probably involving selective breeding, could be undertaken to further enhance the genetic potential of these buffaloes.

Key words: Characteristics, Diara, Production, Reproduction, Riverine buffaloes

Buffaloes, being resistant to various diseases, are ideally suited to the small holder low input dairying system widely adopted in the country. India possesses 13 registered breeds of buffaloes scattered across the country. Besides, there are also some population of buffaloes, with genetically inherited and distinguishable traits, which are still not well documented due to various reasons. Diara is also one of the lesser known buffaloes which is distributed in Gangetic riverine districts of Bihar. Other than Shankar and Mandal (2010) and Sanker *et al.* (2012), there are no research works and published papers on Diara buffaloes. However, these buffaloes have got mention in the official website of Central Institute for Research on Buffaloes (CIRB 2014). Being an important entity in animal genetic resources of Bihar and plays a vital role in the livelihood of buffalo farmers, a study was undertaken to investigate the characteristics in terms of morphological, production and reproduction performances.

MATERIALS AND METHODS

A study was undertaken in 47 villages under Barh, Athmalgola, Belchhi, Pandarak and Mokama blocks of Patna district. A standard questionnaire for studying Diara buffaloes was prepared with the help of breed descriptors developed by Food and Agriculture Organization (FAO

1986). The morphological features of Diara buffaloes were studied by close observation on the typical animals found in the study area. Age of buffaloes were judged based on dentition and the information provided by the farmers. The herd size and structure of Diara buffaloes were studied by visiting 183 herds in the study area. The morphometric characteristics of Diara buffaloes under different age groups were recorded by studying 402 animals in the breeding tract as per the standard procedure. Reproduction traits of Diara buffaloes were estimated based on the information provided by the farmers who rear these buffaloes. The body weights under each age group were calculated using Shaeffer's formula by making certain modifications converting the body length and chest girth into inches as given below:

$$\text{Body weight (in kg)} = \frac{\text{BL in inches} \times (\text{CG in inches})^2}{300} \times 0.4536$$

where, BL and CG are body length and chest girth, respectively.

Breeding tract of Diara buffaloes: The breeding tract of Diara buffaloes is almost linear along both sides of banks of Ganges and its tributaries from Buxar to Bhagalpur district in Bihar and to some extent in the territories outside Bihar. The breeding tract lies between 25°N and 26°N latitude and between 84°E and 90°E longitude in the middle Gangetic plains of India. The region where Diara buffaloes survives is almost marshy in most part of the year and getting dried for cultivation only during dry-weather conditions.

Present address: ^{1,2,4,5}Scientist (vetchandran@gmail.com, jeganicar@gmail.com, dr.reenakamal@yahoo.com, drrajnikumari@gmail.com), ³Head (amitavdey_icar@yahoo.co.in), ICAR Research Complex for Eastern Region, Patna.



Fig. 1. Breeding tract of Diara buffaloes.

RESULTS AND DISCUSSION

Morphological features of Diara buffaloes: Diara buffaloes were medium-sized, docile animals with black coat colour and loosely curved horns (Figs. 2–5). The study also revealed that 17.7% animals were possessing varying degrees of white markings on the forehead, and in carpal and pastern regions of forelimbs or tarsal and pastern regions of hind limbs or in both limbs. The extent of white markings on the forehead was quite varying from a small dot to a large irregular patch occupying almost half of the forehead. The animals with white markings were phenotypically more or less similar to the features found in the Nili-Ravi buffaloes of Punjab and Nagpuri buffaloes of Maharashtra. However, inter-breeding of these populations in Diara breeding tract or using the semen doses of these breeds could not be conformed due to paucity of records. Apart from these animals, the study also revealed that there were 6.7% of animals with very light brown coat colour (almost similar to the colour of dried muddy soil) in the entire body. These animals were called as ‘*Bhura*’ by the farmers.

Forehead of Diara buffalo was distinct and marginally convex. The horns were typical with the length varying from 25 cm to 56 cm in adult buffaloes. The horns were oriented laterally downwards, then grew backward and curved forward with semi-coiled curvature at the tip. The eyes were bright and the eyelashes were black in colour. In the surveyed area, there were also 3.4% of animals with unpigmented iris (wall eyes). Muzzle was black in colour except in 5.2% of animals in which there were pink patches in the muzzle. The brisket of adult buffaloes were very prominent. Legs were strong and sturdy whereas hooves were black in colour. Udder of Diara buffaloes was medium in size and compact. The tail twitch was generally black. However, the study revealed that 16.4% of animals had white hair in the tail twitch. The length of the white marking in the tail twitch extended up to 23 cm from the tip.

Male Diara buffaloes for breeding purpose were slightly heavier than their adult female counterparts. In males, the neck was heavily muscled and the body was robust. The penile sheath was medium in size whereas the scrotum was

compact and fit with the body.

Herd structure: Rearing of cattle and buffaloes in India is mostly confined to small holder production system, and management of Diara buffaloes by the farmers in the breeding tract is no exception to it. The herd size of Diara buffaloes is very small with an average being 3.2. The herd structure included 0.07 adult males, 1.7 adult females, 0.6 male calves and 0.9 female calves. The disparity between male and female calves might be due to immediate disposal of male calves by the farmers once dam’s milk yield ceases.

Morphometric characteristics of Diara buffaloes: Morphometric characteristics of Diara buffaloes in terms of its height, body length and chest girth are given in Table 1. Diara buffaloes had wider chest as the chest girth was the longest among the body measurements at all ages followed by body length and height at withers in general. Though height of Diara buffaloes is more or less similar to body length up to 3 years of age, the body length marginally increases in adult Diara buffaloes in both sexes. The study also showed that growth of Diara buffaloes in terms of morphometric traits was perceptible beyond 7 years of age though the growth after 7 years was very marginal. Among the two sexes, males had higher morphometry than their female counterparts at all ages. Moili and Borghese (2005) reported the height at withers of Murrah and Nagpuri breeds of buffaloes to be 142 cm and 140 cm in adult males and 133 cm and 130 cm in adult females, respectively which are similar to the height of Diara buffaloes found in the study. However, the same authors reported the heights of Bhadawari and Surti buffaloes to be 128 cm and 131 cm, respectively in adult males and 124 cm in adult females of both the breeds which are lesser than the heights of Diara buffaloes observed in this study.

More or less similar body length and height, but narrow chest girth was reported by Siddiquee *et al.* (2010) in adult female buffaloes reared in Trishal region of Bangladesh, in which these three principal body measurements were averaged to be 126.22 ± 7.10 cm, 121.77 ± 5.84 cm and 179.00 ± 6.61 cm, respectively. Different morphometry and the conformation of different buffalo breeds might be due to different genotype and or environment in which they are reared.

Body weights of Diara buffaloes: The estimated mean body weights of Diara buffaloes are given in Table 2. The body weight parameters indicated that male Diara buffaloes were heavier than females at all ages and the difference between both the sexes got widened as the animals grew older.

Shankar and Mandal (2010) studied the adult body weight of Diara buffaloes reared within the radius of 15 km in and around Patna and reported that the pooled body weight to be 461.789 ± 3.32 kg, the result of which more or less matches with adult pooled body weight found in the present study.

Similarly, Sorathiya *et al.* (2009) in one-year old Surti buffaloes reported the body weights to be 125.30 ± 2.86 kg in males and 119.91 ± 2.26 kg in females which are



Figs 2–5. 2. Diara bull; 3. Female Diara buffalo; 4. Diara calf; 5. Diara buffalo wallowing in a stream.

comparable to the body weights of Diara buffaloes at similar age found in this study.

Moioli and Borghese (2005) reported the body weights of Jaffarabadi, Murrah and Nili-Ravi to be 600 to 1,500 kg, 750 kg and 700 kg in adult males and 700 to 800 kg, 650 kg and 600 kg in adult females, respectively which are higher than the body weight found in the present study for Diara buffaloes.

The findings in the present study pertaining to the body weights of Diara buffaloes indicate these buffaloes can be regarded as medium sized buffaloes. Varying genetic makeup and different rearing environment might be the reasons for different body weights of buffaloes in different populations.

Production performance of Diara buffaloes: Diara

buffaloes were not poor milkers and they were purely reared for the purpose of producing milk. The average per day milk produced by Diara buffaloes was found to be 7.8 litre and the mean peak yield reached up to 10.5 litre / day. The present study also revealed that the estimated lactation length of these buffaloes was 354.48 ± 4.56 days indicating that the buffaloes were in milk for longer duration beyond the standard lactation length. However, Sanker *et al.* (2012) found the peak yield of Diara buffaloes to be 7.81 ± 0.11 kg, which is lesser than the findings of the present study. Babu (2013) reported the peak yield of Murrah buffaloes maintained in west Godavari district of Andhra Pradesh to be 13.97 ± 1.13 kg, which is much higher than the peak yield of Diara buffaloes found in this study. Varying genetic make-up, availability of green fodder almost throughout the year,

Table 1. Mean $\pm$ SE of morphometric traits (cm) of Diara buffaloes in the breeding tract

Morphometric traits	Diara buffaloes belonging to different age groups							
	Up to 1 year male	Up to 1 year female	1-3 years male	1-3 years female	3-7 years male	3-7 years female	> 7 years male	> 7 years female
Height at withers	95.25 $\pm$ 1.01 (24) [5.19]	94.96 $\pm$ 0.58 (27) [3.19]	121.50 $\pm$ 4.50 (2) [4.50]	117.28 $\pm$ 0.88 (43) [4.94]	126.14 $\pm$ 2.19 (7) [4.59]	131.52 $\pm$ 0.50 (187) [5.23]	142.33 $\pm$ 2.92 (6) [5.02]	133.60 $\pm$ 0.69 (106) [5.35]
Body length	95.50 $\pm$ 0.91 (24) [4.65]	92.96 $\pm$ 0.49 (27) [2.74]	120.00 $\pm$ 4.00 (2) [4.71]	115.95 $\pm$ 0.88 (43) [4.99]	133.57 $\pm$ 2.32 (7) [4.59]	137.39 $\pm$ 0.52 (187) [5.21]	150.67 $\pm$ 3.62 (6) [5.89]	138.36 $\pm$ 0.74 (106) [5.47]
Chest girth	119.54 $\pm$ 0.76 (24) [3.12]	115.93 $\pm$ 0.81 (27) [3.64]	155.00 $\pm$ 10.00 (2) [9.12]	153.14 $\pm$ 0.95 (43) [4.08]	182.71 $\pm$ 2.37 (7) [3.43]	191.11 $\pm$ 0.65 (187) [4.68]	206.50 $\pm$ 2.63 (6) [3.12]	200.79 $\pm$ 0.95 (106) [4.89]
Face length	38.83 $\pm$ 0.52 (24) [6.61]	38.04 $\pm$ 0.38 (27) [5.18]	47.00 $\pm$ 2.00 (2) [6.02]	45.84 $\pm$ 0.54 (43) [7.72]	51.86 $\pm$ 1.10 (7) [5.61]	51.90 $\pm$ 0.24 (187) [6.31]	53.33 $\pm$ 2.12 (6) [9.75]	54.17 $\pm$ 0.42 (106) [8.06]
Face width	21.63 $\pm$ 0.34 (24) [7.69]	21.89 $\pm$ 0.28 (27) [6.62]	18.50 $\pm$ 0.50 (2) [3.82]	16.05 $\pm$ 0.30 (43) [12.08]	21.86 $\pm$ 0.77 (7) [9.31]	19.82 $\pm$ 0.15 (187) [10.19]	23.33 $\pm$ 0.95 (6) [10.02]	21.21 $\pm$ 0.20 (106) [9.56]
Ear length	20.71 $\pm$ 0.32 (24) [7.60]	21.04 $\pm$ 0.26 (27) [6.52]	23.50 $\pm$ 0.50 (2) [3.01]	24.23 $\pm$ 0.20 (43) [5.39]	24.71 $\pm$ 0.64 (7) [6.90]	26.01 $\pm$ 0.16 (187) [8.48]	30.67 $\pm$ 1.67 (6) [13.31]	26.11 $\pm$ 0.18 (106) [7.14]
Tail length	54.54 $\pm$ 0.68 (24) [6.09]	55.00 $\pm$ 0.66 (27) [6.28]	64.50 $\pm$ 0.50 (2) [1.10]	64.23 $\pm$ 0.42 (43) [4.27]	90.00 $\pm$ 1.41 (7) [4.16]	80.21 $\pm$ 0.50 (187) [8.56]	89.67 $\pm$ 4.39 (6) [12.00]	83.63 $\pm$ 0.79 (106) [9.77]
Horn length	6.96 $\pm$ 0.30 (24) [20.97]	6.56 $\pm$ 0.28 (27) [22.52]	17.50 $\pm$ 5.50 (2) [44.45]	15.79 $\pm$ 0.20 (43) [8.47]	22.14 $\pm$ 0.46 (7) [5.49]	28.94 $\pm$ 0.24 (187) [11.42]	31.00 $\pm$ 0.89 (6) [7.07]	28.96 $\pm$ 0.30 (106) [10.49]
Horn circumference	10.83 $\pm$ 0.42 (24) [18.99]	11.22 $\pm$ 0.29 (27) [13.39]	18.50 $\pm$ 5.50 (2) [42.04]	17.02 $\pm$ 0.20 (43) [7.64]	27.29 $\pm$ 0.78 (7) [7.54]	20.14 $\pm$ 0.11 (187) [7.80]	29.17 $\pm$ 0.75 (6) [6.29]	22.80 $\pm$ 0.21 (106) [9.65]

Figures in round parentheses are number of observations whereas figures in the square parentheses are coefficients of variation.

Table 2. Body weight (kg) of Diara buffaloes at different ages

Age	Male	Female
1 year	126.15±2.30 (24) [8.92]	115.44±1.81 (27) [8.16]
2 years	268.26±22.79 (2) [43.23]	251.64±4.16 (43) [10.84]
5 years	411.89±12.94 (7) [8.31]	464.57±3.96 (187) [11.64]
8 years	591.93±10.46 (6) [4.33]	516.10±5.81 (106) [11.58]
Adult pooled	494.99±27.15 (13) [19.78]	483.21±3.58 (293) [12.70]

Figures in round parentheses are number of observations. Figures in the square parentheses are coefficients of variation.

Table 3. Reproduction traits of Diara buffaloes in the breeding tract

Reproduction traits	Mean ±S.E.
Age at first calving (months)	39.45±1.27
Service period (days)	147.23±3.11
Intercalving period (days)	451.17±2.32
Dry period (days)	86.68±3.81

better care of buffaloes as a consequence of complete dependency of livelihood of farmers on Diara buffaloes might be the reasons for rationally better milk production by these buffaloes.

Reproductive performance of Diara buffaloes: Reproduction characteristics of Diara buffaloes in the breeding tract is given in Table 3. The age at first calving and calving interval as reported in the study revealed that Diara buffaloes were regular in their reproductive cycle. The similar traits studied by Kumar *et al.* (2006) for three genetic groups (Murrah, Nili-Ravi and Murrah graded) together, indicated that the age at first calving and calving interval were found to be 41.12±0.35 months and 471.99±5.74 days, respectively, which are very close to the findings of the present study. However, age at first calving, service period, intercalving period and dry period studied by Das *et al.* (2005) in swamp buffaloes of Asom reported the mean values as high as 56.63±0.47 months, 187.30±4.57 days, 510.68±4.53 days and 193.41±4.68 days, respectively. Continuous availability of water in Diara land and regular wallowing of buffaloes in the water might have beneficial effect in thermoregulatory mechanism of Diara buffaloes and thereby might be effecting positive changes in their reproduction performance. This might be one of the reasons for regular reproductive cycle and efficient reproductive performance of Diara buffaloes found in the present study.

Though calving occurred throughout the year, the peak reached in the months of August, September and October indicating that most of the buffaloes come to heat in October, November and December every year. Barile (2005) reported that the reproductive seasonality is mainly seen in buffaloes

due to the secretion of Melatonin, a hormone mostly secreted at night, depending upon the photoperiod, by the pineal gland. Melatonin represents the endocrine signal of the light-dark rhythm in the environment. The role of melatonin in the regulation of circadian and annual rhythm is well known in the control of ovarian activity in seasonal species like buffaloes. As photoperiod in the breeding tract of Diara buffaloes from October to December is very minimum, these buffaloes might express heat symptoms during these days.

ACKNOWLEDGEMENT

The authors wish to express their gratitude to the Director, ICAR Research Complex for Eastern Region, Patna, for his encouragement and support given during the period of study.

REFERENCES

- Babu D S. 2013. Production performance of Murrah buffaloes under organized dairy farm production system in West Godavari district of Andhra Pradesh. *Indian Journal of Applied Research* **3**: 674–75.
- Barile V L. 2005. Reproductive Efficiency in Female Buffaloes. Buffalo Production and Research. pp.77–108. (Eds) Borghese A. Consiglio per la ricerca e la sperimentazione in agricoltura, Istituto Sperimentale Per La Zootecnia and Food and Agriculture Organization of the United Nations, Rome.
- CIRB. 2014. Other breeds Deshila & Punjabiya <http://www.buffalopedia.cirb.res.in/index.php?option=comcontent&view=article&id=87&Itemid=92&lang=en>.
- Das A, Das D, Goswami R N, Das G C and Bhuyan D. 2005. Performance of swamp buffaloes of Assam in respect of some economically important traits of reproduction under farm condition. *Buffalo Bulletin* **24**: 25–28.
- FAO. 1986. Animal Genetic Resources Data Banks. 2. Descriptor list for cattle, buffalo, pigs, sheep and goats. *FAO Animal Production and Health Paper* **59/2**: 34–55.
- Kumar S, Yadav M C, Singh B P and Prasad R B. 2006. Relative importance of reproductive traits on herd life milk production and profit in buffaloes. *Buffalo Bulletin* **25**: 90–94.
- Moioli B. and Borghese A. 2005. *Buffalo Breeds and Management Systems*. Buffalo Production and Research. (Eds) Borghese A. FAO REU Technical Series 67, FAO, Rome, Italy.
- Sanker S, Mandal K G, Kumar D, Mahajan V and Kumar N. 2012. Factors influencing peak yield and days to attain peak yield in different grades of buffaloes. *Indian Journal of Animal Research* **46**: 288–91.
- Shankar S and Mandal K G. 2010. Genetic and non-genetic factors affecting body weight of buffaloes. *Veterinary World* **3**: 227–29.
- Siddiquee N, Faruque M O, Islam F, Mijan M A and Habib M A. 2010. Morphometric measurements, productive and reproductive performance of buffalo in Trishal and Companiganj sub-districts of Bangladesh. *International Journal of Biological Research* **1**: 15–21.
- Sorathiya L M, Fulsoundar A B and Kharadi V B. 2009. Environmental and genetic effects on body weight in Surti buffalo calves. *Indian Journal of Animal Sciences* **79**: 1176–77.